MN
#5
7-1-93

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	John P. Hancock and Ralph A. McClelland
INVENTION:	REFRIGERANT RECOVERY DEVICE
SERIAL NO.:	07/987,352
FILING DATE:	7 December 1992
GROUP:	3404
DOCKET NO.:	4878.0020

DISCLOSURE STATEMENT

The Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

This statement is filed in the application identified above pursuant to 37 C.F.R. §1.97 and §1.98, as a means of complying with the applicant's duty under 37 C.F.R. §1.56. The Commissioner is hereby authorized to charge Deposit Account No. 09-0007 for any fee which may be necessary for the filing of this disclosure statement.

No representation is intended that a complete search has been made of the prior art or that no better art than that listed is available. Those documents indicated below by an asterisk (*) are documents cited by the Examiner in the parent application (07/676,740 filed 28 May 1991) to the instant Application.

DOCUMENTS

DOCUMENT NUMBER	NAME
4,261,178	Cain
4,363,222	Cain

4,364,236	Lower
4,441,330	Lower
4,523,897	Lower
4,688,388	Lower
4,768,347	Manz
4,798,055	Murray
*4,805,416	Manz
4,809,520	Manz
4,878,356	Punches
4,938,031	Manz
4,939,905	Manz
1,938,205	Yeomans
*2,044,096	Moran
2,321,964	Zieber
2,341,429	Elsey
2,341,430	Elsey
2,865,442	Halford
2,577,598	Zwickle
2,590,061	Ash
2,917,110	Brohl
2,972,235	Smith, B.D.
2,986,894	Endress
3,177,680	Rasovich, et al
3,131,548	Chubb, et al
3,232,070	Sparano
3,357,197	Massengale
3,478,529	Boykin
3,729,949	Talbot
3,872,687	Bottum et al
3,915,857	Olson
4,110,998	Owen
4,236,381	Imral, et al
4,285,206	Koser
4,304,102	Gray
4,456,149	Sciortino
4,470,265	Correia
*4,476,688	Goddard
4,480,446	Margulefsky
4,513,578	Proctor
RE32,451	Proctor

4,539,817	Staggs
4,554,792	Margulefsky
4,614,231	Proctor
4,624,112	Proctor
*4,646,527	Taylor
4,776,733	Scuderi
4,862,699	Lounis
4,909,042	Proctor
4,916,915	Flinchbaugh
4,942,741	Hancock, et al
RE33,212	Lower
5,036,675	Anderson
5,005,375	Manz et al.
5,042,271	Manz
5,005,369	Manz
2,056,646A	U.K.
0,071,062	European
0,313,079	European
*2,511,967	Campbell
*3,811,291	Schibbye
*3,874,192	Kato
*3,978,685	Taylor
*4,537,038	Alsenz et al
*4,903,499	Merritt
*4,934,390	Sapp

DISCUSSION

The Examiner's attention is first directed to pages two through four of the instant application wherein some of the references set forth above are discussed.

The Examiner's attention is next directed to the discussion below of the references set forth above.

AA. Cain U.S. Patent No. 4,261,178.

Cain discloses a refrigerant recovery system having a compressor 22, an evaporator 32 disposed upstream from the compressor, a pressure switch 44 disposed upstream from the evaporator, and means for being coupled to a refrigeration system disposed upstream of the pressure switch 44. A condenser 34 is disposed downstream of the pump, and a storage tank 24 is disposed downstream of the condenser. A scale 52 is provided for determining when the tank 24 is full.

AB. Cain U.S. Patent No. 4,363,222.

Cain '222 relates to a combined refrigerant recovery and refrigerant charging device. The Cain '222 device includes a vacuum pump 60 for withdrawing refrigerant from refrigeration systems. The refrigerant withdrawn is then passed through a pressurized outlet 66. After leaving the pressurized outlet 66, the refrigerant passes through a condenser 70, and into a refrigerant storage disposal tank 74. A charging tank 80 is also provided for introducing refrigerant into the system. Refrigerant leaves the refrigerant charging tank 80, passes through a measuring and charging cylinder 76 having a sight glass at 78 and is introduced into the refrigeration system to be charged. A vaporizing heat coil may be disposed within coil 86 which is disposed upstream from the pump 60.

AC. Lower U.S. Patent No. 4,364,236.

Lower '236 discloses a refrigerant recovery device having a solenoid valve 60, a filter 64 disposed downstream from the solenoid valve, a heat exchanger 66 disposed downstream from the filter 64 and an oil separator 68 disposed downstream from the evaporator. Refrigerant then passes through compressor 90 and through condenser 94. The refrigerant is then

transferred into a storage tank 96 where it is held temporarily until the evacuation process is complete. The refrigerant 96 is then passed from reservoir 96 back into the air conditioning system from which it was evacuated.

AD. Lower U.S. Patent No. 4,441,330.

The Lower '330 patent is a divisional patent of the Lower '236 patent. Thus, similar subject matter is disclosed in both patents.

AE. Lower U.S. Patent 4,523,897.

The Lower '897 patent relates to a two-stage vacuum pump.

AF. Lower U.S. Patent No. 4,688,388 and Reissue Patent No. RE33,212.

The Lower '388 device relates to an automatic recovery and charging system. The device includes a vacuum and charging means that includes a vacuum pump, a pressurized source of refrigerant, and means for connecting the vacuum pump and pressurized refrigerant source to the refrigerant equipment to be charged. The Lower '388 device also includes an alphanumeric display means and a control means. The control means includes an automatic mode of operation for connecting a pressurized refrigerant source to the refrigeration equipment in an automatic mode to transfer a preselected quantity of refrigerant to the refrigeration equipment.

AG. Manz U.S. Patent No. 4,768,347.

The Manz '347 patent relates to a device for removing refrigerant from a refrigeration system. The device includes a solenoid valve 28 disposed upstream from a combination heat

exchanger/oil separator. Refrigerant flows in through the evaporator portion of the heat exchanger, wherein oil is separated. Refrigerant then flows out of the evaporator through a compressor 18, and back into the condenser portion of the heat exchanger. The refrigerant flows out of the compressor into a refrigerant storage tank. A scale device is coupled to the tank to determine when the tank is full.

The '347 device also includes a solenoid valve for selectively admitting refrigerant to the evaporator, means responsive to operator actuation for selectively applying electrical power to the solenoid valve, means responsive to a first pressure sensor for removing power from the solenoid valve, and a means responsive to the content responsive means for inhibiting application of electrical power to the solenoid valve.

AH. Murray U.S. Patent No. 4,798,055

The Murray device relates to a refrigeration system analyzer that includes a hand held calculator shaped device 20 that is coupled by a cable 24 to a temperature probe. The device includes a microprocessor for processing information received by the temperature probe.

A temperature probe is manually placable at various points, such as T1-T8 (Fig 5) around a refrigeration loop. The temperature is recorded at these various points. From these recorded temperatures, the microprocessor within the device can diagnose "fault conditions" in the refrigeration system. These fault conditions include such things as refrigerant undercharge, bad compressor, low evaporator air flow, bad expansion valves and restrictions in the liquid line. See column 10, lines 22-42. The Murray patent also includes a discussion of various superheat relationships. See, for example, column 8, at lines 35 et seq.

AI. Manz U.S. Patent No. 4,805,416.

The Manz '416 patent is a continuation-in-part of the Manz '347 patent. The '416 patent discloses a refrigerant recovery and purification device that includes a manifold 32 that is connectable to an automotive air conditioning system. Refrigerant to be evacuated passes through the evaporator portion of a combined heat exchange/oil separation unit 26, then flows out of the evaporator, through a filter 44 and into the input end of a compressor 22. Compressed refrigerant is then passed through the condenser portion of the combined heat exchange assembly 26, and ultimately into a storage tank 58.

A scale 72 is placed under the tank to determine whether the tank is in a full condition. A return loop is also provided for circulating refrigerant from a second port of the refrigerant storage tank 68, through the filter 34, and then back into the first port of the storage tank.

The '416 device also includes a "recharging valve for selectively connecting the second port to the refrigeration system for selectively feeding refrigerant from the storage means to the refrigeration system," and "means for indicating operating condition of said filter means as a function of pressure drop of refrigerant passing through said filter means."

AJ. Manz U.S. Patent No. 4,809,520.

The Manz '520 patent is a divisional application of the Manz '347 patent. As such, its disclosure is believed to be generally identical to the '347 patent.

AK . Punches U.S. Patent No. 4,878,356

Punches relates to a scale for a storage tank used in conjunction with a refrigerant recovery system. The Punches device includes a platform 38 on which the storage tank 12 rests. An arm 20 is cantilevered to a base 16 by a screw 22 which extends between the base and the

arm 20. The arm includes a bolt 50 positioned to contact and actuator 46 of a limit switch 44 when the weight of the storage tank 12 on the platform 38 reaches a predetermined level.

BA. Manz U. S. Patent No. 4,938,031.

The Manz '031 patent is a divisional application of the Manz '347 patent. Thus, the disclosures contained in the two patents are believed to be virtually identical.

BB. Manz U.S. Patent No. 4,939,905

The Manz '905 device relates to a refrigerant recovery system capable of recovering at least two different types of refrigerants. The device includes a compressor for withdrawing refrigerant from a refrigeration system, and at least two condensers having independent refrigerant flow paths. Turning now to fig 1, you will notice that three independent condensers 58, 60, 62 are provided. Upstream of each of the condensers are three solenoid valves 50, 52, 54. Downstream from the condensers are separate storage tanks for each of the condensers.

The manner in which the device appears to operate is that all refrigerant withdrawn from any system is pulled through a common evaporator 30 and compressor 22. After leaving compressor 22, the refrigerant is funneled into the appropriate condenser through the operation of the solenoid valves 50, 52 and 54. After leaving the condensers 58, 60, 62, the refrigerant is directed to the appropriate storage tank.

The patents set forth above (Nos. AA through BB are grouped together because they are all owned by Robinair or Kent-Moore Corp., which are related companies. As such, they bear many similar design features. The patents listed below are owned by a wide variety of other persons or entities.

BC. Yeomans U.S. Patent No. 1,938,205.

Yeomans discloses a refrigeration system having a compressor 7, a condenser 10 and an evaporator 5. It should be noted that Yeomans uses a dual compressor system having a primary compressor 7, and a turbine-like compressor 16 upstream from the evaporator.

BD. Moran U.S. Patent No. 2,044,096.

Moran relates to a dry-cleaning system having a recirculating pump 32 which circulates fluid from a tank, through a filter 10, and through a pipe 20 into a washer.

BE. Zieber U.S. Patent No. 2,321,964

Zieber relates to a device wherein a mixture of refrigerant vapor, water vapor and air is drawn from the main condenser 13, and is delivered to a secondary purging condenser 23 which is operated at a lower temperature than the main condenser. A secondary compressor is provided for withdrawing refrigerant vapor with air and water from the main condenser, and delivering such to the secondary condenser. In the secondary condenser, the refrigerant is liquified. Water flows out of the secondary condenser through a drip pipe 35 into a water separator, and then is fed back to the evaporator 11 of the refrigeration system. In the embodiment shown in Fig. 1 an oil trap 57 can also be used.

BF. Elsey U.S. Patent No. 2,341,429

Elsey discloses a refrigerant reconditioning bypass circuit which can be attached to a refrigeration system. The bypass circuit includes a reclaimer 37 and a filter 38 which are both disposed downstream of the condenser 35. The refrigerant reconditioning bypass circuit can be

connected between the condenser and the evaporator, to clean up refrigerant as it flows in the refrigeration loop.

BG. Elsey U.S. Patent No. 2,341,430.

The Elsey '430 patent is similar to the Elsey '429 patent, in that both use a similar circuit. However, the absorbent used in the Elsey '430 patent differs from that used in the '429 patent.

BH. Halford U.S. Patent No. 2,865,442.

The Halford patent relates to a fuel supply system for liquid fuel engines, such as jet airplane engines. The Halford device uses the recirculation of a portion of fuel to heat other fuel flowing through a filter, to keep the filter from freezing.

BI. Zwickle U.S. Patent No. 2,577,598.

Zwickle '598 discloses a water remover and air concentrator for removing air and water from refrigerant. As best shown in Fig. 2, the water remover and air concentrator includes an evaporator 11 and condenser 14 in a heat exchange relationship. A purge compressor 6 is provided for purging air from the system.

BJ. Ash U.S. Patent No. 2,590,061.

Ash relates to a liquid cooling tank 1 having a refrigeration coil 1A disposed within the tank for keeping the liquid within the tank at a predetermined temperature.

BK. Brohl U.S. Patent No. 2,917,110.

Brohl relates to a theromastatically controlled valve 60 for preventing vapor lock in a fuel filter of an automotive vehicle.

CA. B.D. Smith U.S. Patent No. 2,972,235.

Smith relates to a device for purifying an ethylene refrigerant. Ethylene is introduced into the system through a line 11. The ethylene is directed into a drum 12. From drum 12, ethylene is passed to compressor 14, where the ethylene is compressed, and then directed to a knockout drum 16. Oil is separated from the ethylene in the knockout drum. The ethylene then passes through a cooler, and through a heat exchanger 24. The ethylene is further cooled to its dew point in heat exchanger 24 by the vaporization of propane in the heat exchanger 24. The ethylene is then directed to a liquid ethylene tank 32, which serves as a condenser. The ethylene can then be returned to line 11, and ultimately to drum 12.

CB. J.W. Endress U.S. Patent No. 2,986,894.

Endress discloses a purge recovery arrangement for refrigeration systems. The refrigeration system to which Endress couples his device includes a compressor 10 having a condenser 12 disposed downstream of the compressor 10, and an evaporator 15 disposed upstream of the compressor 10. A separation tank 20 is disposed downstream of the condenser 12. A purge line 18 is provided that includes a restricted orifice 19 and a strainer 19'. The purge line 18 conducts refrigerant from the condenser to the separation tank 20. A cooling coil 23 is disposed in the separation tank 20 so that gasses entering the chamber are passed over the coil 23 in a heat exchange relation to thereby condense any refrigerant or water vapor carried

by the noncondensable gasses to separate the refrigerant and water from the noncondensable gasses.

CC. Rasovich et al U.S. Patent No. 3,177,680

Rasovich shows a refrigeration system with a composite unit 13. Unit 13 includes lower and upper compartments 14 and 15 respectively that serve as the receiver and accumulator components of the system.

CD. Chubb et al U.S. Patent No. 3,131,548.

Chubb relates to a refrigeration purge control which includes a compressor 26 disposed downstream of a condenser 14. The compressor 26 is the first element in a purge arrangement. A condenser 34 is disposed downstream of the compressor, and a separator 38 is disposed downstream of the condenser. Air is separated from the refrigerant and discharged from the separator at vent 41. Tube and valve arrangement 42 is provided for discharging separated water from the separator. Purified refrigerant is then directed through conduit 43 and 46 into the inlet of evaporator 21.

CE. Sparano U.S. Patent No. 3,232,070.

Sparano relates to a refrigerant saver having a compressor 50 for withdrawing refrigerant from a refrigeration system. The compressor 50 discharges refrigerant into a condenser 56. A motor 82 driven fan 86 passes air over the condenser 56 to cool it. Refrigerant that is discharged from condenser 56 is directed through a filter dryer 74 into a tank 14.

CF. Massengale U.S. Patent No. 3,357,197.

Massengale relates to an apparatus which includes an evaporator 12 coupled by a conduit 18 to a separator chamber 20. Through the action of solenoid valve 19, material from the evaporator 12 can flow from the evaporator 12 to the separator chamber 20. A bottom discharge valve 46 is provided for discharging pollutants such as oil and water from the separator chamber 20. To help pressurize the separator chamber 20 for forcing the oil and water out, solenoid valve 48 can be opened to allow refrigerant from the condenser 11 to pressurize the interior of the separator chamber 20. It should be noted that solenoid valve 21 is actuated in response to the level of pollutants and refrigerant in the separator chamber 20.

CG. Boykin U.S. Patent No. 3,478,529.

Boykin discloses a device for purifying refrigerant of the type commonly used at industrial plants. The primary components of Boykin's device include a make up-surge tank 1 and an evaporator 2, an indirect heat exchanger-separator 3, a reservoir-heat exchanger 4, a separator tank 6, a compressor 7 and a cooler 8.

CH. Talbot U.S. Patent No. 3,729,949.

Talbot relates to a device for helping to determine the proper amount of refrigerant to be introduced into a refrigeration system during the charging of the system. The Talbot device includes a bellows 34 or 36 which is coupled through pressure gauges 26 or 28, respectively, to the head pressure of the refrigeration system.

When the system is charged with proper head pressure, the action of the bellows will interact with the circuit (Fig. 2) to cause a light to go on, thus signalling to the user that the refrigeration system is fully charged.

CI. Bottum, et al. U.S. Patent No. 3,872,687

Bottom, et al. discloses a vehicle air conditioner with a suction accumulator 98. Suction accumulator 98 includes dessicant contained therein to remove moisture from the refrigerant.

CJ. Olson U.S. Patent No. 3,915,857.

The Olson '857 patent relates to a method for conserving water in a household. The Olson device discloses a series of pipe and valve arrangements so that waste "whitewater" can be recycled through a filter and receiving tank to be reused within a household system.

CK. Owen U.S. Patent No. 4,110,998.

The Owen '998 reference relates to a device for removing contaminants from refrigeration system. The Owen device includes a liquid tube 15 for withdrawing liquid refrigerant from the high pressure side of the refrigeration system. The refrigerant flows from liquid tube 15, through a manifold 28, and into a discharge tube 19. The refrigerant then flows past a moisture indicator 21, through a filter 22 and into a capillary tube 23. An evaporator coil 24 is provided downstream of the capillary tube 23 for reducing the pressure of the refrigerant by enabling the refrigerant to change from its liquid state into its vapor state in the evaporator coil 24. The refrigerant then flows through a second filter 25, and ultimately into the low

pressure side of the refrigeration system. A source of new refrigerant 34 is also coupled to the manifold 18 for introducing new refrigerant into the refrigeration system.

DA. Imral et al U.S. Patent No. 4,236,381

Imral et al relates to a suction liquid heat exchanger having an accumulator and receiver. The heat exchanger 10 includes an inner accumulator vessel 20 having a cylindrical enclosed casing 21 including a cylindrical sidewall 22. An outer vessel 40 is disposed outwardly of the inner accumulator vessel 20. The outer vessel forms a receiver or jacket about the inner vessel 20.

DB. Koser U.S. Patent No. 4,285,206.

The Koser '206 patent relates to a refrigerant recovery and recharging apparatus. The Koser device includes a conduit 11 having a flexible end for connecting the device to an air conditioning system. A pump 14 is coupled at its inlet side to the air conditioning system to be evacuated. The pump 14 is provided for producing a vacuum level at the connection 71 to remove essentially all of the refrigerant from the air conditioning system, and for producing pressure at the outlet of the first pump 14 for liquefying the refrigerant. An evaporator 21 is disposed upstream from the pump 14 and downstream of the connection 71.

A condenser 22 is coupled downstream from the pump 14 for liquefying the refrigerant flowing out of the outlet of the pump 14. A tank 32 is provided for receiving liquified refrigerant from the condenser 22. A first powered valve such as solenoid valve 19 is disposed between the evaporator 21 and the air conditioning system connection 71. The solenoid valve 19 is movable between an open and a shut position. A second powered valve such as solenoid

valve 26 is also movable between an open and a shut position, and is disposed downstream of the condenser 22 and upstream of the first tank 32.

A first pressure switch 18 is disposed upstream of the evaporator 21 and downstream of the air conditioning system connection 71. Pressure switch 18 is provided for sensing the pressure in the intake conduit 11, and is operatively coupled to both the first and second solenoids 19, 26 for automatically shutting the first and second solenoids 19, 26 when the pressure sensed in the line 11 drops to a predetermined level that indicates that all refrigerant is withdrawn from the air conditioning system. The first and second solenoid valves 19, 26 are also operatively coupled to a second pressure switch 27. Second pressure switch 27 is provided for detecting blockage in the system, such as when the filter 12 is clogged.

The Koser device also includes a moisture indicator 29 which is disposed downstream of a second filter 28. The moisture detector 29 includes means for generating an alarm indication when the moisture sensed by the moisture indicator reaches a predetermined level.

As best shown in Fig. 2, a heat exchanger means can be provided for connecting the condenser 81 to the evaporator 79 so that the latent heat involved in condensation of the refrigerant in the condenser 81 may be utilized for evaporation of the refrigerant in the evaporator 79. The heat exchange means includes an air transport means, such as a fan 78 for producing an air stream for moving the air first to the evaporator 79, and then to the condenser 81.

The Koser device can also serve as a refrigerant charging station. To this end, the Koser device includes a fourth powered valve, such as solenoid valves 46 or 63, that are disposed between storage tank 32 and vacuum pump 56. A fourth pressure switch, such as switches 56, 58 are disposed between the vacuum pump 56 and the air conditioning system for sensing the

pressure thereat. The pressure switches 56, 58 are operatively coupled to the fourth valve 46 or 63, for shutting down the vacuum pump 56 and opening the solenoid valve 46 when the pressure sensed by the pressure sensing valve 55 or 58 drops to a predetermined value.

When the Koser device is in a charging mode, a sight glass is used to determine when the tanks 47, 36 are empty. An optical detector can be attached to the sight glass 51 to terminate charging should the supply run out, or to switch supplies by means of valves 46 and 48 from reclaimed to fresh refrigerant.

DC. Gray U.S. Patent No. 4,304,102.

Gray relates to a refrigerant purging device for purging non condensable gases (such as air) from the refrigerant in a refrigeration system. The Gray device includes a main purging chamber 26 disposed downstream of the evaporator of the refrigeration system for which the purging is required. A secondary purging chamber 38 is disposed downstream from the main purging chamber. A conduit 72 couples the outlet of the second purge chamber 38 and an inlet of the main purge chamber 26, so that a "loop" is formed so that refrigerant can pass from the second purged chamber to the main purge chamber 26. A condensing coil 38, 36 is disposed in each of the main purge chamber 26 and second purge chamber 38.

DD. Sciortino U.S. Patent No. 4,456,149.

Sciortino relates to a pump for pumping water from a five gallon water bottle into an automatic ice maker or the like. The Sciortino device includes various switches for controlling the action of the pump for automatically turning the pump on and turning the pump off in response to certain conditions. Additionally, a time delay is also provided for deactivating the pump to limit the maximum amount of water pumped during a single demand activation.

DE. Correia U.S. Patent No. 4,470,265.

Correia relates to a refrigerant charging system for dispensing a predetermined amount of refrigerant (by weight) into a refrigeration system. The Correia device includes a strange gauge scale 14 upon which a cylinder 22 is carried. The cylinder includes a piston 44 for isolating the upper portion of the cylinder 40 from the lower portion of the cylinder 42. The piston 44 activates a switch upon reaching a predetermined position which automatically stops the charging of refrigerant into the refrigeration system.

DF. Goddard U.S. Patent No. 4,476,688.

The Goddard '688 patent relates to a refrigerant recovery system that includes a compressor 18, a conduit 16 for coupling the compressor to a refrigeration system, an oil trap 8 in the first conduit, a condenser 32 coupled to the compressor by a second conduit 23, an evaporator 21 disposed in a heat exchange relationship with the condenser 32, and a third conduit 11. Third conduit 11 conveys refrigerant from receiving (storage) tank 42 , to and through the evaporator 21. An expansion valve 5 is disposed in the third conduit 11.

A storage tank 42 is coupled to the condenser 32 by a fourth conduit 36. A filter dryer is disposed in the fourth conduit 36. A fifth conduit 46 is coupled to the storage tank 42. A sixth conduit 29 is coupled to the evaporator 34 and the first conduit 16 for conveying gaseous fluid from the evaporator 21 to the compressor 18.

DG. Margulefsky U.S. Patent No. 4,480,446.

The Margulefsky '446 patent relates to a refrigerant cleaning device that includes a cylindrical tank 46 having an upper inlet 50 and a lower outlet 52. A filter 124 is disposed

within the tank for dividing the interior volume of the tank into an upper contaminated liquid refrigerant receiving area, and a lower clean liquid refrigerant receiving and retaining area.

DH. Proctor U.S. Patent No. 4,513,578 and

DI. Reissue Patent No. RE32,451

Proctor relates to an air conditioning charging station wherein a scale 18 is provided on which is mounted both an oil reservoir 23 and a refrigerant reservoir 20. The scale is capable of producing an output signal proportional to the combined weight of the oil and refrigerant reservoirs. This output signal is used for controlling the valves in the refrigerant charging device. An adjustable weight differential input is provided for enabling the user to program preselected weights of refrigerant and oil to be discharged into the air conditioning system.

DJ. Staggs U.S. Patent No. 4,539,817.

The Staggs device relates to a refrigerant recovery device that includes a storage tank 29 having a heat exchange coil 53 disposed therein. The heat exchange coil 53 can serve in an "evaporator" mode to cool the interior of the tank 29, to help draw refrigerant from the air conditioning system to be charged into the interior of the tank. The evaporator 53 is a part of a heat pump system wherein the flow of refrigerant into the system can be reversed so that coil 53 within tank 29 can serve as a heated condenser to cause refrigerant in the tank 29 to expand when such refrigerant is to be reintroduced into the air conditioning system from which it was removed.

DK. Margulefsky U.S. Patent No. 4,554,792.

The Margulefsky '792 patent is a division of the Margulefsky '446 patent. As such, the subject matter disclosed is generally similar.

EA. Proctor U.S. Patent No. 4,614,231

The Proctor '231 patent relates to an evaporator core assembly that is especially adapted for use in connection with automotive air conditioning systems.

EB. Proctor U.S. Patent No. 4,624,112.

The Proctor device relates primarily to an automotive air conditioning charging station. Although Proctor discloses means for evacuating refrigerant from an air conditioning system, there does not appear to be any structure disclosed for recovering the purged refrigerant.

EC. Taylor U.S. Patent No. 4,646,527.

The Taylor '527 patent discloses a refrigerant recovery and purification system. Refrigerant from a refrigeration system to be evacuated is directed by conduit 24 into an accumulator 32. A check valve 28 and a filter 30 are disposed in conduit 24. Taylor utilizes a pair of sequential accumulators 32,34. Heat exchange coils 42, 46 are disposed in each of the accumulators 34, 32 respectively. Refrigerant that collects in the accumulators is vaporized off and passed through a compressor 12. The output from the compressor is directed first to the heat exchange coils 42, 46 and then into a pair of sequential condensors 50, 52. Refrigerant flowing out of the second sequential condenser 52 is then directed to a storage tank (not shown).

ED. Scuderi U.S. Patent No. 4,776,733.

Scuderi relates to a refrigerant reclamation and charging system having a line 52 that extends between the refrigeration system to be evacuated 12 and an inlet port of a refrigerant storage tank 14. Another line 39 extends between another refrigerant port 18 to a tee connector 50. Tee connector 50 connects line 39 to line 52. Line 39 includes a compressor 40, a condenser 42, a high pressure gauge 44, a back pressure regulator 46 and a check valve 48.

EE. Lounis U.S. Patent No. 4,862,699.

The Lounis '699 reference relates to a device for recovering refrigerant from a refrigeration system, and separating lubricants from the refrigerant. The Lounis device includes a reservoir 20 having a heater 50 disposed therein. The reservoir 20 has insulation material 22 disposed about it. A compressor 24 is provided for aiding in the evacuation of refrigerant from the refrigeration system 12. Prior to the beginning of evacuation, the compressor draws a vacuum into the storage tank 20. This vacuum helps to draw liquid refrigerant out of the refrigeration system. During the beginning of the operation of the Lounis system, the compressor 24 is turned off. The compressor 24 then turns on to pull gaseous refrigerant from the refrigeration system.

After all of the refrigerant is in the storage tank 20, the heater 20 then turns on to help vaporize the refrigerant in the tank 20, to cause the refrigerant to separate from the lubricant contained therein. The lubricant remaining in the bottom of the tank can either be reintroduced into the refrigeration system 12 or transferred to receiving tank 72 having a valve 88 through which the refrigerant can be drained from the receiving tank 22 and dumped. Flow meter 46 is provided for measuring the amount of lubricant or refrigerant removed from the refrigeration system, or lubricant or refrigerant reintroduced into the refrigeration system 12.

EF. Proctor U.S. Patent No. 4,909,042.

The Proctor '042 patent appears to be an improvement on the device disclosed in the Proctor 4,624,112 patent. Proctor '042 discloses a device which removes contaminated refrigerant from a refrigeration system, measures the amount of refrigerant and lubricant removed, and then recharges the refrigeration systems with the same refrigerant. Any additional refrigerant needed for the refrigeration system is added by "makeup refrigerant" from a refrigerant storage means. The Proctor device includes electronic sequencing means and delivery conduit means for charging an air conditioning system with a predetermined quantity by dispensing substantially all of the refrigerant from said refrigerant receiving means, and as needed, makeup refrigerant from said refrigerant storing means."

EG. Flinchbaugh U.S. Patent No. 4,916,915

Flinchbaugh relates to a system for measuring the refrigerant-to-lubricant ratio of liquid within a conduit of a refrigeration system. The system involves the use of a first transducer for generating at least one pulse of ultrasonic energy which is transmitted via the wall, and is received by a second transducer. Circuitry determines the velocity of the transmitted pulse, and uses this velocity to help determine the refrigerant-to-lubricant ratio.

EH. Hancock and McClelland, U.S. Patent No. 4,942,741.

The Hancock and McClelland patent relates to a device invented by applicants for recovering the refrigerant from refrigeration system. The device includes a refrigerant storage tank 35 having an oil separator 54 disposed therein. The device also includes a filter dryer 68, a compressor 82 and a plurality of valves such as valves 110, 42 and 120 for controlling the flow of fluid within the device and storage tank arrangement.

EI. Lower Reissue Patent No. RE33,212.

See discussion re: Lower U.S. Patent No. 4,688,388 at page 5, above.

EJ. Anderson U.S. Patent No. 5,036,675.

Anderson relates to a portable refrigeration system and process for flushing and cleaning an installed refrigeration system. The Anderson device includes a compressor 16, a condenser 17, a receiver 18, an evaporator 19 and a heat exchanger 20, all of which are in full communication with each other. The cleaning system also includes one or more dehydrators 21 and 22 and one or more filters 23 and 24, along with various other conduits, valves and other minor components. Anderson's cleaning system is designed to cause the refrigerant as a vapor or as a liquid to pass through a dehydrator 21 or 22 and also through a filter 23 or 24.

EK. Manz, et al. U.S. Patent No. 5,005,375.

Manz, et al. relates to a quick disconnect coupling system for use in coupling a refrigerant recovery device to a storage tank.

FA. Manz U.S. Patent No. 5,042,241.

The Manz's 241 patent relates to a refrigeration recovery device which includes an oil separator 38 which comprises a closed canister 62. A coil 70 is disposed along the exterior of the canister 62 in a heat exchanged relationship therewith. Hot refrigerant vapor is fed through the coil 70 which heats the wall of the canister 62 to prevent condensation of refrigerant vapor within the canister 62.

FB. Manz U.S. Patent No. 5,005,369.

The Manz '369 patent relates to a refrigerant recovery device having an automatic air purge valve 100. The automatic air purge valve 100 serves the purpose of automatically purging air from storage tank 80 when air becomes entrained in the top of storage tan 80. In operation, the device of the Manz '369 patent is similar to the device shown in Manz U.S. Patent No. 4,805,416, in that it relates to a recirculating-type refrigerant recovery device.

FC. Merritt U.S. Patent No. 4,903,490.

Merritt discloses a refrigerant recovery system having a storage tank 28 which is surrounded by an annular jacket 26. The jacket 26 helps to maintain the storage tank 28 at a low temperature to thereby foster the condensation of refrigerant within the storage tank 28.

FD. Campbell U.S. Patent No. 2,511,967.

Campbell relates to a gas and liquid separator of the type especially adapted for removing entrained oil from steam. The device includes a shell, into which is placed a baffle or wall to divide the interior into an outer annular space and an interior chamber. The first stage of separation occurs in the outer chamber. The steam then flows into an inner chamber in which a further separation takes place, and then through a filter.

FE. Schibbye U.S. Patent No. 3,811,291.

Schibbye relates to a device which includes means for introducing liquid refrigerant to the compression phase of a refrigeration system ahead of the oil separator, to maintain oil within the oil separator at a sufficiently low temperature. Means are also provided for adjusting the

amount of liquid refrigerant introduced so as to keep the temperature difference between the condenser and the oil separator on a constant level of between about 5° celsius and 15° celsius.

FF. Kato U.S. Patent No. 3,874,192.

Kato discloses a device which includes a high pressure liquid conduit 4 which is provided in the exhaust gas conduit 3 that connects a refrigerator 1 and an oil separator 2 to each other. As a result of this arrangement, coolant atomized in the exhaust gas conduit 3 is easily evaporated by the high temperature exhaust gas, whereby the exhaust gas as well as oil mixed therewith in a form of mist are cooled by the latent heat upon evaporation. Thereby, gas supplied to the condenser 7 can be previously cooled while the oil component can be put in a state for easy separation from the gas.

FG. Taylor U.S. Patent No. 3,978,685.

Taylor discloses a foam trap 12 which is provided for helping to separate oil from refrigerant that is exhausted from a compressor 2. Taylor's device provides a relief for excess foam that is generated during the start up of a compressor in a refrigeration system. Some of the foam generated vents through a conduit 13 that extends to the bottom of foam trap 12 from a point in the crank case located above the oil level at start up. A conduit 14 extends from the top of the foam trap 12 to the suction cavity 5 of the compressor. The foam trap 12 is of such a volume and surface that the foam will collapse therein, the oil drains back through conduit 13 of the crank case, and a separated refrigerant vapor is drawn through conduit 14 to suction cavity 5.

FH. Alsenz U.S. Patent No. 4,537,038.

Alsenz relates to a method and apparatus for controlling the pressure in a single compressor refrigeration system, which includes a timer for establishing a selected time period functionally related to the compressor on-off cycle, a pressure detecting means for establishing and detecting an operating suction pressure range within the system for determining when upper and lower limits of the operating pressure have been exceeded, and means for generating a compressor turn-on signal in response to exceeding the upper limit of the operating range. The device also includes means for generating a compressor turn-off signal in response to exceeding the lower limits of the operating pressure range, and control means for receiving the compressor turn-on signal for applying the turn-on signal to the compressor in response to the suction pressure exceeding the operating pressure range upper limit.

FI. Sapp U.S. Patent No. 4,934,390.

Sapp relates to a device for cleaning refrigeration equipment by flushing all refrigerant paths with high pressure refrigerant, following an initial evacuation to prevent air contamination of the refrigerant. A pump-down procedure at the termination of the cleaning process returns all refrigerant to a first tank of the cleaning apparatus, and a contaminant removal procedure removes contaminants from the refrigerant in a second tank.

FOREIGN PATENT DOCUMENTS

AL. United Kingdom Patent Application (Schultze et al) No. 2,056,646A.

This U.K. Patent Application relates to a liquid/gas separating apparatus for use in connection with the refrigeration system. The device includes an operating chamber 1 for

separating oil out of a compressed gas stream, an operating chamber 2 for degassing this return oil, an operating chamber 3 for separating liquid out of the intake gas stream, and an operating chamber 4 for collection of the condensed refrigeration liquid.

AM. European Patent Application (Tuberoso) No. 0,071,062.

Tuberoso relates to a multiple function thermo-dynamic fluid reservoir. Tuberoso's reservoir includes a first portion 14 adapted to contain the liquid phase of material, and a second portion 22 adapted to contain the gaseous phase.

AN. European Patent Application (Torii et al) No. 0,313,079.

Torii European Patent Application No. 0,313,079 relates to a falling film evaporator which is arranged to cause a liquid film to flow downward to thereby affect heat exchange using evaporation. In a space of an evaporating compartment 31 a gas liquid separator 22 is disposed to communicate with a compressor 11 which constitutes a part of a refrigeration cycle.

A completed Form 1449 is enclosed herewith, along with copies of all the references set forth above.

Respectfully submitted,
ICE MILLER DONADIO & RYAN

E. Victor Indiano
Registration No. 30,143

ICE MILLER DONADIO & RYAN
One American Square, Box 82001
Indianapolis, Indiana 46282-0002
(317) 236-2290
IBB0764A